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The Maryland Naturalist

A BIENNIAL PUBLICATION OF THE NATURAL HISTORY SOCIETY OF MARYLAND

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Pine-Barren Golden-Heather (Cistaceae: *Hudsonia ericoides* L.): Range Extension and a New Woody Plant for Maryland

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For a number of years now, I have been on the trail of a turn-of-the-century (1800-1900) botanist, Dr. Charles C. Plitt, who along with friends and students, regularly botanized a 400-square mile (1,000 km²) area around Baltimore (Fessenden 1954). My goal has been to relocate some of his many botanical finds in Anne Arundel County, which I have done with mixed success (Sipple 1993, 1999). My searches have centered principally on four rare vascular plants—the swamp pink (*Helonias bullata*), climbing fern (*Lygodium palmatum*), dwarf iris (*Iris verna*), and wild lupine (*Lupinus perennis*). Although I have located all four of these species, in some instances it is difficult to determine whether Dr. Plitt and his followers were at the exact same site.

On May 24, 2000, while searching for the wild lupine and dwarf iris along a number of dirt roads, roadsides, and open rights-of-way in Anne Arundel County, I made a significant discovery along a Baltimore Gas & Electric Company's transmission line right-of-way off Marley Station Boulevard. I found a new woody vascular plant for Maryland, the pine-barren golden-heather (*Hudsonia ericoides* L.) in the Rock Rose Family (Cistaceae). At the time, I located just one clump, since I had to leave the site due to an approaching thunderstorm. I returned to the site, however, on June 3 to conduct a more extensive search for the heather, only to find that the site had been mowed (since my first visit). My initial thoughts were that the heather clump had been destroyed. As I indicate below, mowing to manage vegetation is very important in keeping such sites open, and in this instance the mowing did not affect the heather, given its low stature. I relocated the original clump and found additional aggregations of eleven, two, and fifteen plants as I progressed further north-northwest along a 230-foot stretch of the right-of-way.

On my second visit to the site, I listed the following vascular plants within a 10-foot radius of the first clump I had found: blackberry (*Rubus* sp.), sheep sorrel (*Rumex acetosella*), matting rosette grass (*Dichanthelium meridionale*), frostwort (*Helianthemum* sp.), broomsedge (*Andropogon virginicus*), Virginia pine (*Pinus virginiana*), creeping bush-clover (*Lespedeza repens*), a tall hairy bush clover (*Lespedeza* sp.), sassafras (*Sassafras albidum*), southern red oak (*Quercus falcata*), sweet vernal grass (*Anthoxanthum odoratum*), white thoroughwort (*Eupatorium album*), dwarf dandelion (*Krigia virginica*), horseweed (*Erigeron canadensis*), poverty wild oat grass (*Danthonia spicata*), forked rush (*Juncus dichotomus*), and wavy hair grass (*Deschampsia flexuosa*).

At another clump further down the right-of-way, I found the following species within a 5-foot radius: matting rosette grass (*Dichanthelium meridionale*), broom panic grass (*D. scoparium*), glaucous greenbrier (*Smilax glauca*), sheep sorrel (*Rumex acetosella*), old-field toadflax (*Linaria canadensis*), frostwort (*Helianthemum* sp.),

broom sedge (*Andropogon virginicus*), Virginia pine (*Pinus virginiana*), sassafras (*Sassafras albidum*), poverty wild oat grass (*Danthonia spicata*), and wavy hair grass (*Deschampsia flexuosa*). The tree species in both plots were merely scrub-like due to periodic maintenance cutting. (Although I had used a 10-foot radius earlier, the 5-foot radius used here appeared to adequately sample the associated species.)

Voucher specimens (Sipple 2032, 2033, and 2034) of the pine-barrens golden-heather have been submitted to herbaria at Delaware State University (DOV), the Philadelphia Academy of Natural Sciences (ANSP), and the Anne Arundel County Community College. Voucher specimen 2034 was originally sent to Bill McAvoy (Delaware Natural Heritage Program), who concurred with my identification.

According to the Anne Arundel County soils survey (Kirby & Matthews 1973), the soil in the area is Evesboro loamy sand. The soil is sandy, and at six inches I obtained a Munsel color designation of 10YR 3/4, moist. The soil survey indicates that the Evesboro series consists of very deep, well-drained to excessively drained, very sandy upland soils. They are formed primarily on old dune-like deposits of sand, with native vegetation consisting chiefly of scrub hardwoods with local invasions of Virginia pine.

Since the pine-barren golden-heather is not listed in *Rare, Threatened and Endangered Plants of Maryland* (Maryland Department of Natural Resources 1996), I inquired with the Maryland Natural Heritage Program (Lynn Davidson, personal communication, 2000) and the Delaware Natural Heritage Program (Bill McAvoy, personal communication, 2000) about its status in the two states. As I suspected, this species has never been reported from Maryland and is considered extremely rare in Delaware. Steiber (1967, 1971) did not list this species in his Anne Arundel County flora, and in *Woody Plants of Maryland*, Brown & Brown (1972) state that it "...has never been reported in Maryland, but has been found in Delaware and adjacent Virginia." In his *Flora of Delaware and the Eastern Shore*, Tatnall (1946) cites only Delaware collections. In *Gray's Manual of Botany*, Fernald (1950) mentions its presence in Delaware but suggests that reports from Virginia need verification. Although McAtee (1918) reported it from the Norfolk-Virginia Beach area, it is not listed for Virginia by Harvill et al. (1992). Gleason & Cronquist (1991) in their *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*, cite only Delaware for the Delmarva Peninsula. The Natural Resources Conservation Service's PLANTS database (<http://plants.usda.gov/plants/>) lists this species from all of the New England states, as well as New York, New Jersey, Delaware, and South Carolina, but not from Maryland or Virginia. Given the above historical status, I was quite surprised to find this plant in such an historically, well-botanized area of the state.

According to Fernald (1950), the pine-barren golden-heather prefers dry sands, pinelands, and acidic rocks. Gleason and Cronquist (1991) cite its presence in pinelands, as does Tatnall (1946) specifically for Delmarva. I have seen this plant growing in such sites, particularly in sandy openings, in the New Jersey Pine Barrens. It has also been documented from pitch pine (*Pinus rigida*) woodlands at Cape Henlopen, Sussex County, Delaware (Bill McAvoy, personal communication, 2000; McAvoy 277, DNHP), its only known Delaware and Delmarva station. Therefore, on my two earlier visits and a June 10, 2000 visit to the Anne Arundel County site, I searched the Virginia pine and Vir-

ginia pine-mixed oak forests on both sides of the right-of-way hoping to find some openings in the pine supporting the heather, but found none. The nature of the forest in some areas astride the right-of-way suggests that they were more open in the past, and xeric forested knolls do exist. Given the topography in the area and the sandy soils, I suspect that the heather once occurred here independent of the right-of-way.

As an aside, some forested sections at the site support an open understory of wavy hair grass, resulting in a vegetation type (Virginia pine-wavy hair grass) that I have not seen before in Maryland or elsewhere.

Although Dr. Plitt did not find the pine-barren golden-heather in Anne Arundel County, he did observe ample wild lupine and dwarf iris along paths, roads, and other openings during his "tramps" to various sites. The impression given by Plitt was that both species were fairly abundant in certain areas. In this regard, it is interesting to note that the pine-barren golden-heather site, as well as the only known extant sites for wild lupine and dwarf iris in Anne Arundel County, are along transmission line rights-of-way, and there is only one known site for each of these species. From a rare plant perspective, this speaks well for such rights-of-way, particularly if they are maintained in natural vegetation by periodic cutting or burning, which allows such plants to exist. The openings are particularly important since so many disturbed sites associated with road cuts and other clearings are commonly planted with tall fescue (*Festuca arundinacea*)—a species that tends to out-compete native plants. In fact, while traveling much of Anne Arundel County in search of such rarities, I have found little in the way of "natural" roadside sites supporting native vegetation at the interface of the road and forest, due to the planting of tall fescue.

Many rare plants have also been reported from other Coastal Plain powerline rights-of-way. For example, 22, 12, and 31 rare species have been documented for Georgia, Maryland, and Virginia, respectively (Sheridan et al. 1997), some of which are state threatened or endangered. The presence of these species was likewise attributed to periodic maintenance of the vegetation along the rights-of-way.

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The Dragonflies and Damselflies (Insecta:Odonata) of Cove Point, Calvert County, Maryland

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This paper summarizes the field work conducted in 1998 and 1999 at the Cove Point Liquefied Natural Gas (LNG) Limited Partnership Site (Cove Point) under a research contract with the Cove Point Natural Heritage Trust. The purpose of the field work was to survey for dragonflies and damselflies residing at Cove Point's pristine and managed aquatic habitats. These habitats included, but were not limited to, marshes, ponds, streams, and forest seeps. Also included in this paper are notes on the dragonfly *Tachopteryx thoreyi* found on 17-June-2000 at Cove Point.

Cove Point consists of 406 hectares just south of Calvert Cliffs, in Calvert County, Maryland on the western shore of the Chesapeake Bay. Approximately 243 hectares are subject to a conservation easement that was granted to the Maryland Environmental Trust and the Nature Conservancy to oversee.

Since 1998, fifty-four (54) species of dragonflies and damselflies have been recorded for Cove Point. Twenty-four (24) of these species were first records for Calvert County. One species, *Gomphus rogersi*, is ranked as "highly state rare" in Maryland (DNR 1999). Three species *Tachopteryx thoreyi*, *Cordulegaster bilineata*, and *Somatochlora filosa*, have Maryland state ranks of "state rare", while six species, *Archilestes grandis*, *Amphiagrion saucium*, *Anax longipes*, *Gomphaeschna furcillata*, *Celithemis fasciata*, and *Libellula axilena*, have been assigned to Maryland's "watch list" (DNR 1999).

The largest aquatic habitat at Cove Point is the Chesapeake Bay. No evidence was found that the bay provided any sustained larval odonate development. However, the influx of the bay waters into the next largest aquatic habitat at Cove Point, Cove Point Marsh, clearly influenced the mix of odonate species. Cove Point Marsh at 77 hectares provides the largest fresh, to slightly brackish, water habitat at Cove Point. Cove Point Marsh is a 1,800 year old (Beardslee and Leatherman 1996), nontidal freshwater baymouth barrier wetland (Sipple 1982). This unique marsh contains an impressive number of plant species, including many Maryland listed endangered, threatened, and rare species (Steury 1997 & 1999).

The man-made ponds of Lake Levy (6 hectares), Osborn Pond (1 hectare) and the Stormwater Pond (2/5 hectares) are also conspicuous wetland habitats at Cove Point. These ponds were created during the mid 1970s as part of a soil disposal plan required by the digging of a tunnel under the Chesapeake Bay. This tunnel connects the main LNG plant complex to the offshore ship-docking station. Each of these man-made ponds is managed differently resulting in various modified aquatic habitats. This in turn affects the species composition and population levels of the dragonflies and damselflies found at these ponds.

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Cove Point also contains an extensive patch work of seepages and small forest streams. Although these small streams and seepages produce far fewer individual dragonflies and damselflies than the ponds or Cove Point Marsh, they do provide larval habitat to a host of odonate species not found elsewhere at Cove Point. This includes three out of the four rarest dragonfly species found at Cove Point. These stream/seepage habitats have great conservation significance.

Except for the *Tachopteryx thoreyi* information added in 2000, all field data were collected on June 5, July 7, July 29, August 22, September 11, September 30, October 14 and December 2 in 1998. In 1999 field data were collected on January 3, March 31, April 23, April 30, May 21, June 6, July 8, September 3 and October 7. The survey was based on binocular identification of easy to identify adults, netted adults (specimens were kept when laboratory identification was required), collection of larva using aquatic nets, and hand collection of mature larval cast skins. The species, date, and habitat (along with any noteworthy behavior or life-history observations) were recorded for 11,419 individual dragonflies and damselflies (data points) over the course of the survey.

LIST OF SPECIES

The following is a complete list of all species of dragonflies and damselflies which were recorded from Cove Point. A summary of their larval aquatic habitat preferences, location, abundance, flight period, and other pertinent biological information is also provided. The common names used are those recommended by the Dragonfly Society of the Americas (DSA 1996).

Key to the list:

(*) = new species record for Calvert County

(**) = rare or unusual—should be protected and monitored

(v) = voucher specimen taken and/or photographed

Maryland State Rank (DNR, 1999)

(S1) = highly state rare

(S2) = state rare

(S3) = watch list

(S4) = apparently secure

(S5) = demonstrably secure

(SA) = stray individual—does not complete its life cycle in Maryland

DAMSELFLIES

Calopterygidae (Broad-winged Damselflies)

1. *Calopteryx maculata* (Beauvois, 1805)—Ebony Jewelwing—(S5). This conspicuous species is common at Cove Point along wooded streams. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 23-Apr-99, 6-Jun-99 and 8-Jul-99. Larvae were collected from a small stream cutting across the gasoline right-of-way on 23-Apr-99. Ebony jewelwings

were often seen mating and ovipositing at Cove Point. This species is widespread and common in Maryland. Its larval habitat is forested streams and rivers.

Lestidae (Spreadwings)

2. *Archilestes grandis* (Rambur, 1842)—Great Spreadwing—(*) (S3). This species is rare at Cove Point with only two records of adult males seen at the entry streams of the Stormwater Pond on 11-Sep-98 and 30-Sep-98. Since the wooded vegetation was removed from the Stormwater Pond late in 1999, the future success of this species at this location is questionable. Although not found elsewhere during the survey, it is likely that this species also occurs along forest streams elsewhere at Cove Point. The great spreadwing is a fall-flying species that is widespread in Maryland but uncommon. It is the largest damselfly in North America. Its larval habitat is wooded streams.

3. *Lestes disjunctus australis* Walker, 1952—Common Spreadwing—(*) (v) (S5). This spreadwing is fairly common in the spring and fall (but difficult to find during mid-summer) along the Stormwater Ponds and Lake Levy. Adults were observed on 11-Sep-98, 30-Sep-98 and 23-Apr-99. Common spreadwings were often seen mating and ovipositing at Cove Point. This species is the most common and widespread *Lestes* in Maryland. Its larval habitat is ponds and lake edges with emergent vegetation.

4. *Lestes rectangularis* Say, 1839—Slender Spreadwing—(v) (S4, S5). A single adult male was observed at Cove Point at the base of Lake Levy dam on 29-Jul-98. This is a widespread and common species in Maryland and probably occurs at Cove Point in greater numbers than the single record would indicate. Its larval habitat is ponds and lake edges with emergent vegetation.

Coenagrionidae (Pond Damsels)

5. *Amphiagrion saucium* (Burmeister, 1839)—Eastern Red Damsel—(*) (v) (S3). This damselfly is rare and very local in sunny grassy seeps at Cove Point. Adults were observed on 21-May-99 and 6-Jun-99 along the seepages bordering the streams that cut across the gasoline right-of-way. This is a widespread species in Maryland but limited to very localized populations. The larval habitat is sunlit grassy seeps.

6. *Argia fumipennis violacea* (Hagen, 1861)—Variable Dancer—(*) (S4, S5). A single adult male was observed at Cove Point on 11-Sep-98 at the small parking lot near the Jay Walk that leads to the beach. This species is widespread and common in Maryland and the reason that it is not more abundant at Cove Point is not known. The larval habitat is almost any still or slow moving water.

7. *Enallagma aspersum* (Hagen, 1861)—Azure Bluet—(*) (v) (S3, S4). This is a common species at the Stormwater Pond. Isolated adults can also be found at Lake Levy and Osborn Pond. Adults were observed on 29-Jul-98, 22-Aug-98, 11-Sep-98 and 8-Jul-99. The females of this species at the Stormwater Pond (22-Aug-98) were observed inserting

eggs into stonewort (*Chara fragilis*) while completely submerged and decoupled from the guarding male who waited on the surface for their return. The species is widespread and common in Maryland. The larval habitat is ponds, usually with no or few fish.

8. *Enallagma basidens* Calvert, 1902—Double-striped Bluet—(*) (S4). Adults were observed on 5-Jun-98 at the Stormwater Pond (two males) and another lone male on Osborn Pond on 11-Sep-98. This species is widespread but uncommon in Maryland. Its larval habitat is ponds.

9. *Enallagma civile* (Hagen, 1861)—Familiar Bluet—(v) (S5). This is the most abundant species of odonate at Cove Point where it can be found in nearly all aquatic habitats from early spring into early winter. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 14-Oct-98, 2-Dec-98, 23-Apr-99, 21-May-99, 6-Jun-99, 8-Jul-99, 3-Sep-99 and 7-Oct-99. The familiar bluet was often seen mating and ovipositing at Cove Point. Emergence of adults from Lake Levy continued to occur throughout the year well into October. This species is very common and widespread in Maryland. Its larval habitats are fresh and slightly brackish ponds, marshes, and lakes.

10. *Enallagma signatum* (Hagen, 1861)—Orange Bluet—(*) (v) (S4). At Cove Point this species is common (ponds/marsh) to abundant (Lake Levy) but often inconspicuous. Adults were observed on 11-Sep-98, 14-Oct-98 and 3-Sep-99. Orange bluets were often seen mating and ovipositing at Cove Point. The orange bluet is a widespread and common species in Maryland. Its larval habitats are marshes, ponds, and lakes.

11. *Ischnura hastata* (Say, 1839)—Citrine Forktail—(v) (S4, S5). An uncommon and inconspicuous damselfly at Cove Point found in sunlit grassy seepages along the edges of ponds, marshes, and streams. Adults were observed on 7-Jul-98, 30-Sep-98 and 6-Jun-99. This is a widespread and common species in Maryland. Its larval habitat is sunlit seepages with dense short grass/rush/sedge emergent vegetation. This was the smallest odonate species found at Cove Point.

12. *Ischnura posita* (Hagen, 1861)—Fragile Forktail—(v) (S5). A common, widespread, inconspicuous damselfly at Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 23-Apr-99, 21-May-99 and 6-Jun-99. The fragile forktail was often seen ovipositing along with *I. ramburii* and *I. verticalis* on the floating mats of *Potamogeton pectinatus* at Lake Levy. This species is probably the most abundant and widespread odonate species in Maryland but is not as abundant at Cove Point as *I. ramburii*, *I. verticalis*, *Enallagma signatum*, and *E. civile*. Its larval habitat is non-flowing fresh water.

13. *Ischnura ramburii* (Selys, 1850)—Rambur's Forktail—(v) (S4). This and *Enallagma civile* are the dominant damselflies of Cove Point Marsh. In addition, the adults of *I. ramburii* are often found in good numbers at other locations especially Lake Levy and Osborn Pond. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 14-Oct-98, 23-Apr-99, 21-May-99, 6-Jun-99, 8-Jul-99, 3-Sep-99 and 7-Oct-99. Rambur's forktails were often seen mating and ovipositing at Cove Point.

In Maryland the larval habitat is slightly brackish water marshes and ponds and is rarely seen off of the Coastal Plain. Even at Cove Point this species is generally replaced by *I. verticalis* when moving from brackish to completely fresh water ponds.

14. *Ischnura verticalis* (Selys, 1839)–Eastern Forktail–(v)(S5). This is a common to abundant damselfly at Cove Point along the marshy edges of Lake Levy, Osborn Pond, and the Stormwater Pond. However, the adults often show up at other locations as well. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 23-Apr-99, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. The eastern forktail was often observed ovipositing at Cove Point. This is a widespread and common to abundant species in Maryland. Its larval habitat is fresh non-flowing water with emergent vegetation.

DRAGONFLIES

Petaluridae (Petalails)

15. *Tachopteryx thoreyi* (Hagen, 1858)–Gray Petaltail–(**)(v)(S2). This large primitive dragonfly was not seen during the 1998-1999 survey. Two adults were observed during a 17-Jun-2000 field trip at the gasline right-of-way near a small stream bordered by numerous seeps. This species is rare and very local throughout its range and is recorded from the Piedmont and Western Shore (Coastal Plain) in Maryland. Its larval habitat is clean, permanent, deciduous forest seeps.

Aeshnidae (Darners)

16. *Aeshna umbrosa* Walker, 1908–Shadow Darner–(*) (v)(S4). This is a rare fall-flying dragonfly at Cove Point. Adults were observed on 14-Oct-98 and 2-Dec-98. This species is widespread and common in Maryland. Its larval habitat is small streams.

17. *Anax junius* (Drury, 1770)–Common Green Darner–(v)(S5). This is the most abundant large species of dragonfly at Cove Point. Both a migratory population and a resident population co-exist at Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 14-Oct-98, 23-Apr-99, 6-Jun-99, 8-Jul-99, 3-Sep-99 and 7-Oct-99. Common green darners were often seen mating and ovipositing at Cove Point. Cast skins were collected from Lake Levy on 7-Jun-98 and the Stormwater Pond on 22-Aug-98 and 11-Sep-98. The common green darner is widespread and common throughout Maryland. Its larval habitat is still or slow moving water.

18. *Anax longipes* Hagen, 1861–Comet Darner–(*) (S3). This is a rare but spectacular species of dragonfly at Cove Point. Single lone males were observed on 5-Jun-98 and 7-Jul-98 and two males observed on 8-Jul-99, all seen flying low over Lake Levy. Although no cast skins were found it is likely that Lake Levy holds a small resident population of comet darners. This is a widespread but uncommon dragonfly in Maryland. This species is listed from a number of Maryland's neighboring states as of conservation importance.

Its larval habitat is ponds and small lakes. It appears that this species may exist only as an extended metapopulation (having a patchy distribution with no obvious "mainland" patches; in which no single larval site is self-sustaining).

19. *Boyeria vinosa* (Say, 1839)–Fawn Darner–(*) (S4,S5). A single adult was observed at Cove Point flying along the edge of the Stormwater Pond on 3-Sep-99. This is a widespread and often common fall-flying dragonfly in Maryland. Its larval habitat is streams and rivers.

20. *Epiaeschna heros* (Fabricius, 1798)–Swamp Darner–(v) (S5). This is an uncommon forest-loving dragonfly at Cove Point. Adults were observed on 21-May-99, 6-Jun-99 and 8-Jul-99 mostly along the gasoline right-of-way. This is a widespread and common dragonfly in Maryland. Its larval habitat is swamps. It is the largest dragonfly in Maryland.

21. *Gomphaeschna furcillata* (Say, 1839)–Harlequin Darner–(S3). A single adult male was observed at Cove Point on 23-Apr-99 flying along the gasoline right-of-way. This is a widespread but uncommon spring-flying dragonfly in Maryland. Its larval habitat is swamps and bogs.

Gomphidae (Clubtails)

22. *Gomphus lividus* Selys, 1854–Ashy Clubtail–(*) (S5). Three adult males were observed at Cove Point along the gasoline right-of-way on 23-Apr-99. This is the most widespread and common clubtail in Maryland. Its larval habitat is streams and rivers.

23. *Gomphus rogersi* Gloyd, 1936–Sable Clubtail–(*) (**) (v) (S1). A small resident population was found in a single stream cutting across the gasoline right-of-way. At the stream the larvae utilize the unshaded, sandy-bottom where there is little or no silt present (*Cordulegaster bilineata* larvae replace *G. rogersi* when silt starts to cover the sandy bottom). The larvae would remain buried just below the sand with only the tip of the abdomen exposed to the surface which appeared as a dark spot against the light colored sand bottom. The only organism that was found in the sampling nets which were of the right size and numbers to be prey for the clubtail were larval northern two-lined salamanders, *Eurycea bislineata* (Green). The dragonfly's larval habitat extended for approximately 4 meters of stream and the stream was approximately 1/3 meters wide.

One *G. rogersi* larva was collected on 31-Mar-99 and seven more on 23-Apr-99 from approximately 1/5 of the total habitat (the other 4/5 of the habitat was left untouched). Assuming that the larvae were evenly dispersed, there maybe a total population (before my removal of 8 larvae) of 40 individuals. The seven larvae collected on April 23 were reared to determine identification. All seven of the larvae emerged between May 12 and May 18 in the laboratory. No adults were ever seen at the site which attests to the difficulty in surveying for clubtails.

Although only 32 individuals were estimated to emerge from this stream in 1999 this still makes it the largest population of this species currently known from the Coastal Plain in Maryland and only 1 of 3 existing known populations in Maryland. Because of the very restricted suitable habitat at Cove Point for *G. rogersi* and due to the small size of the population, it is questionable whether this species will be self-sustaining over the long run at Cove Point.

It may be of future taxonomic interest to note the differences in the Cove Point population and the single known healthy Maryland population of *G. rogersi* at Muddy Creek in Garrett County. At Muddy Creek the larvae are solid brown in color and live in the silt substrate of a slow-moving river on the Alleghany Plateau in far western Maryland. At Cove Point they are greenish-brown in color and live in a sand substrate of a tiny creek on the Coastal Plain.

24. *Hagenius brevistylus* Selys, 1854—Dragonhunter—(*) (v) (S4). A single cast skin was collected at a woodland stream by Brent Steury on 2-Jul-98. This species is widespread but uncommon in Maryland. In Maryland, the dragonhunter is second only to the swamp darter in size. Its larval habitat is streams and rivers.

Cordulegastridae (Spiketails)

25. *Cordulegaster bilineata* Carle, 1983—Brown Spiketail—(*) (**) (v) (S2). Larvae were collected on 31-Mar-99 and 23-Apr-99 from a small stream cutting across the gasoline right-of-way. The larvae prefer the sunlit section of the stream where a thin layer of silt covered an otherwise sandy bottom. Larvae were in three distinct sizes indicating a three-year larval development. A single adult male was observed along the gasoline right-of-way on 6-Jun-99. This is an uncommon to rare spring-flying dragonfly previously recorded from Maryland only from Baltimore, Howard, Anne Arundel, and Prince Georges counties. Its larval habitat is streams.

26. *Cordulegaster maculata* Selys, 1854—Twin-spotted Spiketail—(v) (S4). A single adult male was observed at Cove Point along the gasoline right-of-way on 23-Apr-99. This spring flying species is uncommon but widespread in Maryland. Its larval habitat is streams.

Macromiidae (Cruisers)

27. *Didymops transversa* (Say, 1839)—Stream Cruiser—(*) (v) (S4, S5). Adults were observed at Cove Point on 23-Apr-99 hunting along forested paths. This is a spring-flying species which is common and widespread in Maryland. Its larval habitat is streams and rivers.

Corduliidae (Emeralds)

28. *Epitheca cynosura* (Say, 1839)—Common Baskettail—(*) (v) (S5). Adults were observed on 23-Apr-99, 30-Apr-99, 21-May-99 and 6-Jun-99. Most were found

hawking over the gasoline right-of-way. Mating in flight was observed over the gasoline right-of-way on 21-May-99. This spring-flying species is abundant and widespread in Maryland. Its larval habitat is ponds and very slow moving streams.

29. *Somatochlora filosa* (Hagen, 1861)–Fine-lined Emerald–(**)(v)(S2). An uncommon dragonfly most often seen along the western edge of Cove Point Marsh. Adults were observed on 30-Sep-98 and 3-Sep-99. This species is rarely encountered in Maryland and even then as lone individuals. However, at Cove Point a number of individuals were seen together interacting over the Jay Walk on 3-Sep-99. As far as I am aware Cove Point has the highest concentration of this species in Maryland. Its larval habitat is not known. However, based on the behavior of the adults at Cove Point the most likely larval habitat is the seeps and/or small boggy pools along the western edge of Cove Point Marsh.

30. *Somatochlora tenebrosa* (Say, 1839)–Clamp-tipped Emerald–(v)(S3,S4). At Cove Point this species was occasionally found hunting along forested borders during summer and early fall. Adults were observed on 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98 and 8-Jul-99. A female was seen ovipositing in the small stream just north of the Jay Walk. This is a widespread, but uncommon dragonfly in Maryland. Its larval habitat is forested streams.

Libellulidae (Skimmers)

31. *Brachymesia gravida* (Calvert, 1890)–Four-spotted Pennant–(v)(S3,S4). This is a common species, often seen mating and ovipositing at Cove Point Marsh and Lake Levy. Scattered adults can be found throughout Cove Point during the height of the season. Adults were observed at Cove Point on 7-Jul-98, 29-Jul-98, 22-Aug-98, 8-Jul-99 and 3-Sep-99. In Maryland this species is common in the brackish water marshes surrounding the Chesapeake Bay, but is not found off of the Coastal Plain.

32. *Celithemis elisa* (Hagen, 1861)–Calico Pennant–(*) (v)(S5). This species is common at the ponds during the summer months. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 21-May-99, 6-Jun-99 and 8-Jul-99. This species was often seen ovipositing. I observed a calico pennant being captured and eaten by an eastern pondhawk on 29-July-98. This species is widespread and common in Maryland. Its larval habitat is ponds and marshes.

33. *Celithemis eponina* (Drury, 1773)–Halloween Pennant–(*) (v)(S4,S5). This species is common to abundant at the ponds; it is also found at Cove Point Marsh but in fewer numbers. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 8-Jul-99 and 3-Sep-99. This species was often observed mating and ovipositing. I observed a large fish take a Halloween pennant at Lake Levy on 22-Aug-98. I also saw an eastern pondhawk capture and eat a Halloween pennant. This species is widespread and common in Maryland. Its larval habitat is healthy marshes or the marshy edges around ponds and lakes.

34. *Celithemis fasciata* Kirby, 1889—Banded Pennant-(*)(S3). This species is uncommon at Cove Point and found only at Lake Levy and Osborn Pond. Adults were observed on 5-Jun-98 and 7-Jul-98. This species is restricted to the eastern portion of the Piedmont and western shore in Maryland where it is uncommon. Its larval habitat is marshes or the marshy edges around ponds and lakes.

35. *Erythemis simplicicollis* (Say, 1839)—Eastern Pondhawk-(v)(S5). An abundant dragonfly found throughout Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. Cast skins were collected from Osborn Pond on 7-Jul-98. The eastern pondhawk was often seen mating and ovipositing at Cove Point. This species is abundant and widespread in Maryland. Its larval habitat is any still or slow flowing water.

The eastern pondhawk hunts by staying on the ground and flying up to capture prey in the air. An interesting behavioral observation was noticed between the eastern pondhawk and one of its prey animals, the tiger beetle, *Cicindela hirticollis*, on the beach at Cove Point. The dragonfly would only take the tiger beetle when it was in flight, which would occasionally happen when I disturbed the beetles while walking on the beach. If the beetle managed to land before being captured, the dragonfly would land next to it, often just a couple of inches away. I got the impression (but it does need to be further observed or tested) that the tiger beetle was behaviorally programmed to run and not fly away from the dragonfly—thus avoiding capture. When I approached the tiger beetles they appeared to more readily take to the air than they did when a dragonfly was next to them.

As a side note, I have watched the eastern pondhawk hunt the federally listed northeastern beach tiger beetle, *Cicindela dorsalis*, at Flag Ponds Nature Center a few miles north of Cove Point during the early 1990s, but did not see any captured (only attempts). However, the rangers informed me that they had seen the northeastern beach tiger beetles being taken by the eastern pondhawk. One thing that is for sure is that at the beach at Cove Point and Flag Ponds Nature Center, during the heat of the day, the eastern pondhawks are an active predator of tiger beetles.

36. *Erythrodiplax berenice* (Drury, 1770)—Seaside Dragonlet-(v)(S4). An uncommon species of dragonfly at Cove Point. Adults were observed on 7-Jul-98, 29-Jul-98 and 11-Sep-98. The larvae of this species are restricted to the eastern edge (closest to the bay) of Cove Point Marsh. The seaside dragonlet is the most salt tolerant of any North American dragonfly species and it can be expected that the number of individuals encountered at Cove Point Marsh will be proportional to the influx of bay waters into the marsh. Two of the three female forms of the seaside dragonlet occur at Cove Point Marsh. They are the male-like form and the spot-wing form. In Maryland, this species is restricted to the brackish water marshes of the Chesapeake Bay where it can be very abundant.

37. *Libellula axilena* Westwood, 1837—Bar-winged Skimmer—(*) (S3). A single adult male was observed at Cove Point along the gasoline right-of-way on 8-Jul-99. This species is widespread but uncommon in Maryland. Its larval habitat is temporary pools and the shallow edges of permanent ponds.
38. *Libellula cyanea* Fabricius, 1775—Spangled Skimmer—(v) (S5). A common and widespread species at Cove Point. Adults were observed on 5-Jun-98, 21-May-99, 6-Jun-99 and 8-Jul-99. This species is widespread and abundant in Maryland. Its larval habitat is ponds and lakes.
39. *Libellula deplanata* Rambur, 1842—Blue Corporal—(*) (v) (S4, S5). An abundant early-spring pond species at Cove Point. Adults were observed on 23-Apr-99 and 21-May-99. Cast skins were collected from the edge of Lake Levy on 23-Apr-99. This species is abundant on the Coastal Plain and rare elsewhere in Maryland. Larval habitat is ponds and edges of lakes.
40. *Libellula incesta* Hagen, 1861—Slaty Skimmer—(v) (S5). A common to abundant species at Cove Point most often seen at Cove Point Marsh and the ponds. Adults were observed on 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 6-Jun-99, 8-Jul-99 and 3-Sep-99. The slaty skimmer was often seen mating and ovipositing. This species is widespread and common in Maryland. Its larval habitat is permanent sunlit ponds and lakes. At Cove Point, as elsewhere, this species is replaced by *Libellula vibrans* when the edges of the ponds are shaded.
41. *Libellula luctuosa* Burmeister, 1839—Widow Skimmer—(v) (S5). A beautiful, common to abundant pond dragonfly at Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 6-Jun-99, 8-Jul-99 and 3-Sep-99. I photographed, near Lake Levy, on 6-Jun-99, a large jumping spider (*Phidippus* sp.) eating a teneral widow skimmer which it was able to capture and kill. The widow skimmer is widespread and common in Maryland. Its larval habitat is ponds and lake edges.
42. *Libellula lydia* Drury, 1770—Common Whitetail—(v) (S5). A common pond dragonfly at Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 23-Apr-99, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. Common whitetails were often seen mating and ovipositing at Cove Point. The common whitetail is a widespread, and common to abundant dragonfly in Maryland. Its larval habitat is ponds, ditches, and other (often degraded) still water habitats.
43. *Libellula needhami* Westfall, 1943—Needham's Skimmer—(v) (S4, S5). An abundant, large, orange-red dragonfly found throughout Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 14-Oct-98, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. Needham's skimmer was often seen mating and ovipositing at Cove Point. Cast skins were collected at Lake Levy on 6-Jun-99. This is the most conspicuous summer dragonfly of Cove Point Marsh and Lake Levy. In

Maryland this species is somewhat restricted to the eastern half where it does its best against other species of dragonflies, in slightly brackish still-water habitats. It is very abundant in the semi-freshwater coastal marshes around the Chesapeake Bay.

44. *Libellula pulchella* Drury, 1770—Twelve-spotted Skimmer—(*) (S4,S5). A single adult male (probably a stray) was observed at Cove Point over the Stormwater Pond on 11-Sep-98. This species is widespread and common in Maryland. Its rarity at Cove Point is probably due to the absence of its preferred larval habitat of temporary sunlit ponds.

45. *Libellula semifasciata* (Burmeister, 1839)—Painted Skimmer—(*) (v) (S4,S5). An uncommon species at Cove Point. Adults were observed on 5-Jun-98, 11-Sep-98 and 6-Jun-99 in open fields and along the gasoline right-of-way. This species is widespread and common in Maryland. Its larval habitat is grassy pools and seeps.

46. *Libellula vibrans* Fabricius, 1793—Great Blue Skimmer—(S4,S5). An uncommon large dragonfly found long the shaded sections of ponds. Adults were observed on 5-Jun-98, 22-Aug-98 and 11-Sep-98. This species replaces the much more abundant *L. incesta* in the deep shaded edges of the ponds at Cove Point. This species is widespread and common in Maryland. Its larval habitat is forest ponds.

47. *Pachydiplax longipennis* (Burmeister, 1839)—Blue Dasher—(v) (S5). An abundant dragonfly of Cove Point Marsh and the ponds. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 14-Oct-98, 6-Jun-99, 8-Jul-99 and 3-Sep-99. blue dashers were often seen mating and ovipositing at Cove Point. Cast skins were collected from Lake Levy on 5-Jun-98. This species is the most abundant summer dragonfly in Maryland. Its larvae can be found in almost any still or slow-moving body of water.

48. *Pantala flavescens* (Fabricius, 1798)—Wandering Glider—(S5). A common dragonfly of the ponds at Cove Point. Adults were observed on 29-Jul-98, 22-Aug-98, 11-Sep-98, 6-Jun-99 and 8-Jul-99. This species is widespread and common in Maryland. It is a migrant species that comes north in the spring/summer, lays eggs that develop during the season, and emerge in the fall to migrate south. The wandering glider does not overwinter in Maryland. The adults are most often encountered hawking over open fields. This species is widespread and common in Maryland. Its larval habitat is shallow or temporary ponds.

49. *Pantala hymenaea* (Say, 1839)—Spot-winged Glider—(v) (S5). A common dragonfly of the ponds at Cove Point. Adults were observed on 29-Jul-98, 22-Aug-98, 21-May-99, 6-Jun-99 and 8-Jul-99. The spot-winged glider is a migrant species which comes north in the spring/summer, lays eggs which develop during the season and emerge in the fall to migrate south. The spot-winged glider is more abundant at Cove Point than its close relative the wandering glider. The spot-winged glider does not overwinter in Maryland. The adults are most often encountered hawking over open fields. This species is widespread and common in Maryland. Its larval habitat is shallow or temporary ponds.

50. *Perithemis tenera* (Say, 1839)—Eastern Amberwing—(v)(S5). An abundant tiny dragonfly of Cove Point Marsh and the ponds at Cove Point. Adults were observed on 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 6-Jun-99, 8-Jul-99 and 3-Sep-99. Cast skins of this species were seen in mass on top of floating mats of sago pondweed (*Potamogeton pectinatus* L.) at Lake Levy on 8-Jul-99. I observed an eastern pondhawk capture and eat a male eastern amberwing at Lake Levy on 3-Sep-99. The eastern amberwing is widespread and common in Maryland. This species oviposits on floating algae, vegetation, or other floating objects in open marshes, ponds and lakes.

51. *Sympetrum vicinum* (Hagen, 1861)—Yellow-legged Meadowhawk—(v)(S5). An abundant late-fall early-winter red dragonfly at Cove Point. Adults were observed on 14-Oct-98 and 2-Dec-98 in large numbers over the ponds. yellow-legged meadowhawks were often seen mating and ovipositing at Cove Point well into December. Many more females than males were observed at Cove Point. The reason for this is not known but is not characteristic of this species which normally occurs in a 50/50 sex ratio. This species is the most abundant late fall dragonfly in Maryland. Its larval habitat is ponds and edges of lakes.

52. *Tramea carolina* (Linnaeus, 1763)—Carolina Saddlebags—(v)(S4,S5). A common aerial dragonfly of open areas and the ponds at Cove Point. Adults were observed on 5-Jun-98, 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 30-Sep-98, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. Cast skins were collected from Lake Levy on 5-Jun-98 and 7-Jul-98. Carolina saddlebags were often seen mating and ovipositing at Cove Point. This species is widespread and common in Maryland. It is a migrant species that comes north in the spring, lays eggs that develop during the season and emerges in the fall to migrate south. The Carolina saddlebags does not overwinter in Maryland. The adults are most often encountered hawking over open fields. This species is widespread and common in Maryland. Its larval habitat is shallow ponds.

53. *Tramea lacerata* Hagen, 1861—Black Saddlebags—(v)(S5). An abundant aerial dragonfly of open areas and the ponds at Cove Point. Adults were observed on 7-Jul-98, 29-Jul-98, 22-Aug-98, 11-Sep-98, 21-May-99, 6-Jun-99, 8-Jul-99 and 3-Sep-99. The black saddlebags were often seen mating and ovipositing at Cove Point. This species is much more common than *T. carolina* at Cove Point. Mass emergence of adults at Lake Levy was observed on 11-Sep-98. This species is widespread and common in Maryland. It is a migrant species that comes north in the spring, lays eggs that develop during the season and emerges in the fall to migrate south. The black saddlebags does not overwinter in Maryland. The adults are most often encountered hawking over open fields. This species is widespread and common in Maryland. Its larval habitat is shallow or temporary ponds.

54. *Tramea onusta* Hagen, 1861—Red-mantled Saddlebags—(*) (SA). A single adult male was observed at the Stormwater Pond on 29-Jul-98 where it provided good views through binoculars but stayed out of reach of the net. This species has been recorded from Maryland only 5 times (including the 1998 Cove Point record and the more recent 1999 find in Howard County). This species is a southern species which occurs in our area

only as isolated adult strays. It is unlikely that its larval habitat of ponds and ditches is utilized this far north.

MONTHLY SUMMARIES OF THE SPECIES COMPOSITION OF THE ADULT DRAGONFLIES AND
DAMSELFLIES AT COVE POINT

The 1998-1999 survey at Cove Point recorded 11,417 data points on individual adult odonates as to species, date and habitat. The data collecting technique for creating the monthly summaries, used the minimum number of individual adults of each species seen at any given location. This means that when a species was present in small or moderate numbers the data is reasonably exact, however those species which occur in large numbers are likely underrepresented in the data points.

The following percentages represent the total number of individual adults of a particular species compared to the total number of all individual adult dragonflies and damselflies seen during that month. No data was collected for the month of November and no adult odonates were seen in January, February, and March.

Since Cove Point Marsh and the ponds produced the vast majority of individual dragonflies and the other wetland habitats so few, the following information is characteristic for what one would see at Cove Point Marsh and the ponds and not what would be found along the forested streams and seepages at Cove Point.

APRIL (Based on 380 data points representing 13 species)

66% <i>Libellula deplanata</i>	11% <i>Enallagma civile</i>
9% <i>Anax junius</i>	6% <i>Ischnura verticalis</i>
8% 9 other species	

MAY (Based on 121 data points representing 16 species)

16% <i>Ischnura ramburii</i>	16% <i>Pantala hymenaea</i>
11% <i>Erythemis simplicicollis</i>	10% <i>Libellula deplanata</i>
10% <i>Epitheca cynosura</i>	7% <i>Tramea lacerata</i>
7% <i>Libellula lydia</i>	7% <i>Enallagma civile</i>
16% 8 other species	

JUNE (Based on 1064 data points representing 29 species)

21% <i>Ischnura ramburii</i>	19% <i>Libellula needhami</i>
17% <i>Erythemis simplicicollis</i>	16% <i>Libellula lydia</i>
12% <i>Enallagma civile</i>	15% 24 other species

JULY (Based on 5376 data points representing 33 species)

22% <i>Enallagma civile</i>	13% <i>Celithemis eponina</i>
20% <i>Erythemis simplicicollis</i>	10% <i>Libellula needhami</i>
9% <i>Brachymesia gravida</i>	6% <i>Libellula luctuosa</i>
5% <i>Tramea lacerata</i>	5% <i>Libellula incesta</i>
4% <i>Pachydiplax longipennis</i>	6% 24 other species

AUGUST (Based on 867 data points representing 21 species)

23% <i>Erythemis simplicicollis</i>	23% <i>Pachydiplax longipennis</i>
12% <i>Celithemis eponina</i>	12% <i>Libellula incesta</i>
12% <i>Libellula needhami</i>	3% <i>Enallagma civile</i>
3% <i>Perithemis tenera</i>	3% <i>Ischnura verticalis</i>
9% 13 other species	

SEPTEMBER (Based on 1758 data points representing 31 species)

34% <i>Enallagma civile</i>	15% <i>Perithemis tenera</i>
9% <i>Enallagma signatum</i>	9% <i>Tramea lacerata</i>
8% <i>Libellula needhami</i>	6% <i>Ischnura ramburii</i>
5% <i>Libellula incesta</i>	5% <i>Pachydiplax longipennis</i>
9% 23 other species	

OCTOBER (Based on 1645 data points representing 9 species)

94% <i>Enallagma civile</i>	4% <i>Sympetrum vicinum</i>
2% 7 other species	

DECEMBER (Based on 206 data points representing 3 species)

97% <i>Sympetrum vicinum</i>	2% <i>Enallagma civile</i>
1% <i>Aeshna umbrosa</i>	

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Are Northern Pine Snakes, *Pituophis m. melanoleucus*, Indigenous To Delaware?

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ABSTRACT.— The first records of the northern pine snake, *Pituophis m. melanoleucus*, are provided from the state of Delaware. Two of these from Sussex County are reports that are unsubstantiated by specimens, while the third record is a specimen captured alive in Kent County in 1997. Historical records and reports of pine snakes from the Delmarva Peninsula are reviewed, and those deemed most plausible are plotted on a map of this region. A further review of the distribution of north pine snakes and their associated habitats in the mid-Atlantic states suggest that this snake may have been found throughout the northern portion of the Atlantic Coastal Plain, but has been extirpated from most area as a result of habitat fragmentation and loss. Field surveys are needed to determine the northern pine snakes historical and present distribution.

INTRODUCTION

"These snakes are common in the more southern states of Delaware and Maryland, where they grow very large." (Wallace 1904)

The northern pine snake, *Pituophis m. melanoleucus* (Daudin), is one of the largest and most strikingly patterned snake of the southeastern United States. The above introductory quotation penned by Seward Wallace nearly 100 years ago when he reported on a pine snake found near Piermont, Rockland County, New York, may have been the source of two myths concerning the distribution of this snake: 1) that pine snakes are members of the Delaware and Maryland faunas, and 2) that they are common in these and other states to the south. Apparently, nothing could be further from the truth, as there are no records of this species from Delaware, with only a single museum specimen and a few other unsubstantiated records from Maryland. However, Wallace's statement may have prompted Olive Stull to depict the range of this species on the map in her classic paper on the genus *Pituophis* (Stull 1940) as occurring from extreme southern New York, south throughout most of New Jersey, all of Delaware and the Maryland portion of the Delmarva Peninsula, through southern Maryland and throughout most of Virginia, North and South Carolina, and the eastern half of Tennessee. Wright and Wright (1957) apparently followed Wallace and Stull when they described the range of this species as "...across New Jersey, and e. Maryland; through w. Virginia..." and depicted it on their map as occurring throughout Delaware and the Mary-

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land portion of the Delmarva Peninsula as well as southern Maryland.

Current records suggest a broad gap in the distribution of the northern pine snake along the Atlantic Coastal Plain between the population in New Jersey and populations further south in North Carolina (Sweet and Parker 1990). It is restricted to two widely separated populations in the Coastal Plain of southeastern North Carolina and one smaller population in the extreme southwestern corner of that state (Palmer and Braswell 1995). It apparently only occurs in the mountains of Virginia, but is relatively rare there (Mitchell 1994), and a small population inhabits the nearby mountains of southeastern West Virginia (Green and Pauley 1987). There are several historical references to it (Harris 1975), but only one museum record from the Coastal Plain of Maryland (Grogan 1973). Finally, there are apparently no museum records or literature references of pine snakes specifically from Delaware (Conant 1945, 1947; Sweet and Parker 1990).

In this article, we examine the distribution and habitat preferences of northern pine snakes in the mid-Atlantic states, review all historical records of this species from the Delmarva Peninsula and plot those records that seem most plausible on the map provided herein. We also provide the first records of pine snakes from Delaware: two unsubstantiated reports from Sussex County, and details of a live specimen that was recently captured in Kent County. Finally, hypotheses are presented and discussed as possible explanations of the biogeography of this large burrowing snake at the northeastern portion of its range.

DISTRIBUTION AND HABITAT PREFERENCES IN NEARBY STATES

New Jersey

Throughout most of its range, the northern pine snake is considered by most modern authors as rare to locally common (Conant and Collins 1991). The one exception is the relatively well known population in New Jersey that is restricted to the "pine barrens" of the Coastal Plain in the southeastern portion of that state (Conant 1979). However, despite its mostly diurnal habits, many naturalists and laymen familiar with the herpetofauna in New Jersey, have never seen a live or road-killed (DOR) specimen. This is in part due to its fossorial habits and Conant and Collins (1991) state: "... (it) is so secretive that its presence may be unsuspected even by persons who have lived in the same region with it for years." In New Jersey, its range extends from southern Monmouth County, south through most of Ocean and Atlantic counties, to at least the northern half of Cape May County, and west through the extreme southeastern portions of Cumberland and Salem counties, and the eastern portions of Camden and Burlington counties (Conant 1979). Despite several hundred years of modern human habitation that have resulted in habitat fragmentation and loss, persecution, and over-collection, it remains common in scattered populations in New Jersey where it is currently listed as "State Threatened" (R. Zappalorti, pers. comm.).

The New Jersey pine barrens has two major forest types: uplands, dominated by pitch pine (*Pinus rigida*) and scattered hardwoods (mostly blackjack oak, *Quercus marilandica*, and post oak, *Q. stellata*), and depressions, dominated by Atlantic white-cedar (*Chamaecyparis thyoides*). Pine snakes are nearly always restricted to mixed pine-oak habitats (Zappalorti et al. 1983) and apparently prefer areas that have been

disturbed by humans (Zappalorti and Burger 1985; Burger and Zappalorti 1988). They often use the underground root systems of toppled trees as sites for hibernation or aestivation (Burger and Zappalorti 1988 ; Burger et al. 1988). Females prefer areas with less than 5% ground cover. In random clearings, the vegetation is dominated by grasses, Pennsylvania sedge (*Carex pensylvanica*) and heather (*Hudsonia sp.*), while in forested sites, heather and blueberry (*Vaccinium spp.*) dominate (Burger and Zappalorti 1986, 1991, 1992).

Virginia

This snake was first recorded from Virginia by Dunn (1917) who reported a specimen (USNM 61186) found DOR in Bath County in the Allegheny Mountains on the extreme west-central border of that state. Subsequently, other reports and specimens accumulated from this state, but all records were from the region west of the Blue Ridge Mountains. Recently, Linzey and Clifford (1981) reported it from 11 counties, whereas Tobey (1985) indicated 16 localities in nine counties in Virginia. However, Mitchell (1994) could only substantiate five museum records from Virginia, but listed and plotted 11 additional unsubstantiated records from that state. Although Dunn (1936) listed Northampton County on the Virginia portion of the Delmarva Peninsula as being within the range of this species in that state, Mitchell (1994) could not locate any museum specimens to substantiate this report. Similarly, many decades of fieldwork and museum searches by Conant (1945, 1993), and a more recent review of the reptile fauna of the Virginia Barrier Islands by Conant et al. (1990) and Assateague and Chincoteague Islands by Mitchell and Anderson (1994), have not revealed any specimens from this region.

Mitchell (1994) summarized the distribution of pine snakes in Virginia as "...the Blue Ridge Mountains and Ridge and Valley physiographic regions of western Virginia north of the New River." Unlike the Coastal Plain population in New Jersey, all records from Virginia are typically 500 m or more in elevation. Habitats here are often dry and sandy, and "...vegetation includes scrub pine and thickets of laurel and rhododendron" (Linzey and Clifford 1981). Interestingly, pitch pine is a primary tree species found in the mountainous areas of Virginia (Little and Garrett 1990). Due to the lack of detailed information on populations in Virginia (Mitchell and Pague 1987; Mitchell 1994), this species is currently listed by the Virginia Natural Heritage Program as "Status Undetermined" (J. Mitchell, pers. comm.).

West Virginia

A single museum record of the northern pine snake exists from West Virginia (Carnegie Museum of Natural History 21265), a specimen found during June 1940 in Monroe County in the extreme southeastern corner of that state (Llewellyn 1943). A recent review of the reptile fauna of that state by Green and Pauley (1987) revealed no additional specimens. The habitat where this snake was found in West Virginia is identical with that in nearby Virginia, and the populations in both states are likely contiguous. Due to the paucity of records from West Virginia, this species is ranked as "Status Undetermined" in that state.

North Carolina

In North Carolina, this species is known from a small population in the mountains of the extreme southwestern corner of that state, where it is apparently contiguous with populations in eastern Tennessee, western South Carolina and northern Georgia (Sweet and Parker 1990; Conant and Collins 1991). It also occurs in two narrowly separated populations on the Coastal Plain of North Carolina that represent northern extensions of populations in South Carolina (Palmer and Braswell 1995; Ernst and Barbour 1989). The population at the western periphery of the Upper Coastal Plain in North Carolina includes at least seven counties in an area of that state known as the "Sandhills." Here, pine snakes inhabit "...upland forests dominated by scrub oaks, pines and wiregrass" (Palmer and Braswell 1995). The smaller population on the Outer Coastal Plain in Brunswick and New Hanover counties is "...along the southern coast in woodlands dominated by live oaks" (Palmer and Braswell 1995).

New York

Finally, we return to Wallace's (1904) account of the northern pine snake that was found in the extreme southeastern tip of New York just south of Piermont, Rockland County on the west bank of the Hudson River on Tallman Mountain (ca. 500'). This "mountain" is now included in Tallman Mountain State Park, which extends along the "Palisades" portion of the lower Hudson River valley only 1-3.5 km north of Bergen County, New Jersey. The carcass of this specimen had been partially eaten by ants, but Wallace related that "...the skin was whole." Apparently, however, it was not preserved or otherwise deposited in a museum collection (Stull 1940). Wallace suggested that, "...it is probable that this specimen was a stray and far northward of where it is normally found." This locality is approximately 90 km north of the nearest pine snake record in southern Monmouth County, New Jersey (Zappalorti et al. 1983). Current knowledge of the ecology of northern pine snakes suggests that their activity ranges are fairly limited and Wallace's "stray" hypothesis should be discounted. The specimen from Rockland County either escaped or was intentionally released.

We recently received information from several people about a pine snake that was found 10 July 1995 at Pound Ridge Reservation, a county park in Westchester County, New York, near that state's southeastern border with Connecticut. According to Michael Klemens (*in litt.*), who was with a group when this snake was found alive in a "sand pit" at the end of Boutonville Road, it had obvious signs of captivity as it was emaciated and had a worn rostral scale. It was kept in captivity and attempts were made to return it to normal health, but it subsequently died and was not preserved. Klemens also mentioned that an introduced population of southern fence lizards, *Sceloporus u. undulatus*, had recently been discovered in this same "sand pit". The group was checking on the population status of these lizards (now extirpated), when they found this pine snake. All of the members of this group consider it highly likely that this pine snake was released by the same individual that introduced the lizards into this habitat. Regardless, it is worth noting that this specimen was found some 30 km northeast of the Rockland County, New York specimen reported upon by Wallace (1904).

Presently, it would be unwise to assume that either the Rockland County or Westchester County specimens represent individuals from extirpated or extant popula-

tions in New York. However, there are two forms of evidence which support the idea that pine snakes may have once inhabited the extreme southeastern portion of that state. First, this area is in the center of distribution of pitch pine (Little and Garrett 1990) and the northeastern limit of the range of Virginia pine (Carter and Snow 1990), both of which are habitat associates of pine snakes in New Jersey. Also, some species of snakes, including copperheads and timber rattlesnakes, that were once plentiful in or near the vicinity of New York City, have survived in some refugia in this area well into the 20th Century (Kauffeld 1957; Oliver 1958). In fact, extant populations of these two venomous species are presently known in this region.

Conversely, there are several reasons against the hypothesis that pine snakes historically or currently inhabit the extreme southeastern portion of New York. First, this portion of New York generally lacks loose sandy soils that are typical of the New Jersey pine barrens; well documented as a habitat requirement of this species. In addition, several experiments at lower than normal incubation temperatures have produced hatchling northern pine snakes with congenital abnormalities that reduce their adaptive fitness (Burger 1989, 1991; Burger et al. 1987).

Pennsylvania

It is worth noting here that, soon after the publication of the account of the northern pine snake from Anne Arundel County, Maryland (Grogan 1973), WLG received a letter dated 9 July 1973 from Christopher W. Thompson, then of Huntingdon Valley, Pennsylvania. A biologist with Pennsylvania or a county/region thereof, Thompson had read the report by Grogan (1973) and reported (*in litt.*) that he was preparing a manuscript on the snakes of Pocono Lake Preserve in Monroe County, Pennsylvania. While doing field work in this portion of northeastern Pennsylvania, Thompson claimed to have "...found many snakes which are not indigenous to their range such as...*Elaphe guttata guttata*...*Pituophis m. melanoleucus*, to name a few." Thompson also inquired, "...I was curious to know how many snakes must be found within a certain range in a certain period of time for the snake to (be) said to inhabit the area concerned." An excellent question, and one that we address in more detail below.

RECORDS OF PINE SNAKES ON THE DELMARVA PENINSULA

Historical Records From Maryland

Grogan (1973) reviewed historical records of pine snakes from Maryland. Up to that time, this species was thought to possibly occur on the Eastern Shore (i.e., the Maryland portion of the Delmarva Peninsula). Apparently, the first published reports of pine snakes specifically from Maryland were provided by Kelly et al. (1936) who stated, "The pine snake appears only in the pine and sandy regions of our Eastern Shore." They gave a report provided by the late Dr. R. V. Truitt who described a specimen he had seen from Worcester County (Fig. 1) as follows: "Length—four feet. Head more turtle-like than snake-like. Sides creamy white; darker on back with more or less tan blotches on dorsal region." McCauley (1945) listed the locality of this specimen as "...3/4 mi. from Snow Hill, near Pocomoke River (R. V. Truitt)" and was able to add more details from correspondence with Dr. Truitt who added, "The snake was taken in rather dense growth



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Figure 1. Map of the Delmarva Peninsula with locality records of northern pine snakes. Previous unsubstantiated records from Maryland are indicated by open circles, new unsubstantiated records from Delaware by closed circles. The live specimen from Kent County, Delaware is represented by the closed triangle. Graphic by D. W. Harris, Department of Geography and Geosciences, Salisbury State University.

of pine, approximately twenty-five years of age.....about one-half mile from Snow Hill, Maryland." Many years later (July 1971), WLG visited Dr. Truitt, who seemed surprised to learn that no additional pine snakes had been found in Maryland and provided an approximate date of 1924 for the specimen he examined from Worcester County.

Kelly et al. (1936) also provided the length (1410 mm) and a partial description of a specimen they claimed was taken in August 1930 near Centreville, Queen Anne's County (Figure 1). Apparently, it was subsequently deposited in the collection of the Natural History Society of Maryland (NHSM) in Baltimore. McCauley (1945) examined this specimen and provided a detailed description of it but stated, "...as the snake was not collected by either Dr. Kelly or Mr. Robertson, I have not accepted it." Several attempts to find this specimen in the NHSM during the past 25 years have failed, and it is assumed that it was discarded due to desiccation or was otherwise lost (H. Harris and A. Norden, pers. comm.).

McCauley (1945) provided another compelling account of a pine snake that was found about early September 1936 on Isle of Wight, Worcester County (Figure 1) by personnel at the Civilian Conservation Corps Camp in nearby Ocean City. They provided McCauley with the following information: "It was described as gentle and had been kept in the camp for several days. This specimen was said to be about six feet long, light in color with darker blotches or mottlings. Mr. Walter Connell, the entomologist, had identified it as a pine snake by comparing it with a photograph illustration in a volume on natural history that was available." During the 1970s, WLG attended graduate school at the University of Maryland with Connell's son, John, and learned from him that during ensuing years, his father became Professor of Entomology at the University of Delaware and was renowned as a beetle taxonomist specializing in the family Nitidulidae (Grogan 1973). It is unfortunate that this snake, identified by the young coleopterist as a pine snake, was released just a few days before McCauley arrived at the CCC Camp on 17 September 1936 where Connell worked.

Grogan (1973) reported a pine snake that was found alive in August 1970 on the former Ft. Meade, in Anne Arundel County (Figure 2), by Sgt. Howard DeWeese, then a forest ranger with the U. S. Army. During September 1971, WLG accompanied Sgt. DeWeese to the capture site of this snake and discovered that this forested area consisted of dense pitch and Virginia pines with scattered hardwoods and very loose sandy soil. Grogan noted that this site more closely resembled pine snake habitat in New Jersey, but differed from supposed suitable pine snake habitat on the Eastern Shore where loblolly pines are dominant. Pitch pine reaches its southern limit on the Atlantic coast on the upper third of the Delmarva Peninsula (Little and Garrett 1990), near where the above Centreville specimen was supposedly taken (Kelly et al. 1936). The lower two-thirds of the Delmarva Peninsula is dominated by loblolly pine, the range of which extends south to Florida and west to eastern Texas (Baker and Langdon 1990). Cooper et al. (1973) considered this pine snake from Anne Arundel County as a likely escapee, despite the fact that none of these individuals actually visited the capture site to determine its suitability as possible pine snake habitat. The above Ft. Meade site has subsequently been incorporated into the Patuxent Wildlife Refuge, so if an actual population of pine snakes exists here, they will not be threatened in the immediate future by development. Interestingly, a corn snake (*Elaphe guttata*) was recently found near the site



Figure 2. A northern pine snake from Ft. Meade, Anne Arundel County, Maryland. Photo by William V. Horvath.

where this pine snake was taken (B. Pajak, pers. comm.). Corn snakes are known associates of pine snakes in New Jersey, where they co-occupy the same hibernacula (R. Zappalorti, pers. comm.). Pine and corn snakes also occupy the same habitats in North Carolina, Virginia, and in other southern states. This fact may add some validity to the Anne Arundel County specimen, the only existing museum record (*USNM 194783*) of a pine snake from Maryland.

There are several other reports of pine snakes from the lower Eastern Shore of Maryland, for which we provide brief accounts below, but do not plot these localities in Figure 1. Lee (1972) received a verbal account from Irving Hampe who observed an apparent pine snake swimming in Sinepuxent Bay, a coastal bay south of Ocean City, between the mainland and Assateague Island in Worcester County. Lee also mentioned that a park ranger at Assateague Island State Park claimed that pine snakes swam out to that island to feast on nesting birds in late spring. Grogan (1973) provided a report from Wes Fortney, a park ranger at Shad Landing State Park (8 km southwest of Snow Hill) in Worcester County, who claimed to have seen pine snakes in the vicinity of that state park. Finally, Harris (1975) gave reports he received from two different people in Wicomico and Worcester Counties in which they described "a large white snake with black blotches". This species is currently listed in Maryland as "state reported" (L. Davidson, pers. comm.)

New Delaware Records

Other than the oblique reference by Wallace (1904), there are no historical accounts of pine snakes in Delaware despite an intensive herpetological survey of the Delmarva Peninsula by Conant (1945, 1947), which preceded the first edition of his field guide (Conant 1958). We present two intriguing accounts of pine snakes in Sussex County, one by Michael Geiger (pers. comm.) of Seaford, Delaware and a more recent sighting by CMH. We also report details on the first live specimen ever taken from this state.

Michael Geiger is familiar with the reptile fauna of the Delmarva Peninsula and has provided numerous validated herpetological records during the past 20 years (Arndt 1985; Grogan 1985; Grogan and Forester 1998). During the summer of 1966, an adult pine snake (ca. 160 cm) was captured just west of Seaford, Sussex County (Figure 1) and brought alive to Geiger, who kept it for several days before releasing it at the capture site. Geiger was a young teenager then and his interest in herpetology was just beginning, so he failed to recognize the significance of this specimen. Several years later, when he obtained a copy of Conant's (1958) field guide, he was surprised to learn that the range of pine snakes did not include either Delaware or Maryland. Soon thereafter, he wrote a letter to Dr. Conant who replied back and encouraged him to search for more specimens. All subsequent attempts by Geiger to find additional specimens in southern Delaware have been unsuccessful. It is worth noting that Geiger has made numerous trips to the New Jersey pine barrens where he has found several live and DOR pine snakes, some of which he has photographed (photos verified by WLG).

With Geiger, we visited the site where this snake was captured as it was apparently crawling in the open. We have made several other subsequent visits to this site, either together, singly, or with others, and provide details of this area as follows. This

property is owned by the Dupont Corporation, is designated as a natural area and is thus protected from development (W. Davis, pers. comm.). Its eastern boundary is Woodland Ferry Road (Sussex County Road 536) and it extends west past Chapel Branch (of the Nanticoke River) encompassing an extensive forested area of some 80+ ha of mostly uplands. The dominant trees are loblolly and Virginia pines, oaks, and other hardwoods. There are also scattered open areas dominated with grasses, largely broomsedge (*Andropogon virginicus*). The pine snake found here in 1966 was found crawling above ground in one of these openings at the intersection of several trails in the forest. This wooded area seems to provide suitable habitat for pine snakes and is conceivably large enough to support a small population of this species. Corn snakes are apparently fairly common in this area (Arndt 1985), and as noted above, are associates of pine snakes in New Jersey and other states.

It is worth noting here that Geiger received a report from then resident of nearby Laurel, Delaware, Raymond M. Pusey (deceased), who claimed to have found another pine snake in the vicinity of Laurel-Seafood, perhaps as early as the 1950s. Pusey was apparently familiar with the reptile fauna of Sussex County and supplied several important snake records from Sussex County to Arndt (1985), including the only known specimen of the scarlet snake (*Cemophora coccinea copei*) from Delaware (Grogan 1994).

In June 1993, CMH was conducting field work in extreme southwestern Sussex County (1 km east of Dorchester County, Maryland). While traveling west on Sussex County Road 537, he spotted a large (ca. 160 cm) whitish snake crossing this road. As he passed, he was able to look down on the dorsal area of the snake as it disappeared up a low embankment. He clearly observed the dark blotches on a white background; markings typical of this species. His efforts to locate this snake a few moments later in the dense underbrush on the margin of the forest along the road were in vain. This site (Fig. 1) is about 6 km southwest of the above Dupont site west of Seafood where the live specimen was found in 1966. We have visited this site several times since 1993 in an attempt to find another specimen without success. The forest here is more dense than the Seafood site and is dominated by young loblolly pines in cultivation. Two small branches of Wright Branch drains this area (Nanticoke River drainage) and provides a permanent source of water for resident reptiles and amphibians.

The only existing specimen from Delaware was found during August 1997 in a residential backyard adjacent to Puncheon Run in extreme southwestern Dover, Kent County (Figure 1). It was brought to the Delaware Natural Heritage Program office and has been kept in captivity since its capture. When captured, its estimated total length was about 750 mm, however, it has subsequently grown considerably on a diet of mice. This snake is currently under the care of Jim White at the Delaware Nature Society, Hockessin, Delaware, and will eventually be deposited in that vertebrate collection. It (Figure 3) is a typical example of the subspecies (Sweet and Parker 1990), and by August 1999 had attained a snout-vent length of 1435 mm and total length of 1677 mm. It is a male with 25 body blotches and 8 more blotches on its tail. We noted the following scale counts: ventrals 217; subcaudals 58; supralabials 8-8; infralabials 12-12; prefrontals 4; nasals 2-2, internasals 2; loreals 1-1; supraoculars 1-1; postoculars 3-3; temporals 3-3. The first seven body blotches are more or less coalesced with the sur-



Figure 3. A northern pine snake from Dover, Kent County, Delaware. Photo by C. H. Briand.

rounding dark black pigment, resembling the condition of the specimen from Anne Arundel County, Maryland (Figure 2), which has even more extensive black pigmentation on the anterior portion of its dorsum. However, the ground color of this Delaware specimen is much more diffuse and not nearly as white as that Maryland individual. The venter of the Delaware specimen is bright white with regularly spaced, paired, lateral blotches on the margins of its ventrals, similar to a specimen illustrated in Wright and Wright (1957). In fact, the blotch pattern and overall coloration of this Delaware specimen are reminiscent of that snake from Lakewood, Ocean County, New Jersey.

Due to increased interest in this species by hobbyists, it is highly likely that this Kent County, Delaware specimen represents an escaped or released individual. The wooded area where this snake was found is composed largely of white oak (*Quercus alba*), tulip-poplar (*Liriodendron tulipifera*), hickory (*Carya* sp.) and American beech (*Fagus grandifolia*). However, Puncheon Run flows west to east through this wooded area and connects two substantial areas of upland forests, composed mostly of Virginia pine and a few loblolly pines. Therefore, there remains the possibility that this specimen belongs to a natural population and was using the wooded stream corridor as a passage route between the two adjacent pine forests. It is worth noting that the pine forest 1 km east of the capture site is currently undergoing development, and much of the forest there is likely to be lost during ensuing years.

These reports suggest that populations of this species may still exist in Delaware. However, because the only known specimen from this state was from a residential area, we remain skeptical of its origin. If extant populations of pine snakes remain in Delaware, it is more likely that they occur in the more extensive pine forests of Sussex County. Because of these recent records, this species is now listed in Delaware as "state reported" (Heckscher 1999).

DISCUSSION

The apparent absence of the northern pine snake from the Coastal Plain of Delaware, Maryland, Virginia and most of North Carolina, is difficult to explain. Many species of reptiles and amphibians that occur in the southeastern United States reach the northern extent of their distribution along the Atlantic seaboard in or near New Jersey (Conant and Collins 1991). These include the eastern mud turtle (*Kinosternon s. subrubrum*), northern fence lizard (*Sceloporus undulatus hyacinthinus*), ground skink (*Scincella lateralis*), eastern smooth earth snake (*Virginia v. valeriae*), rough green snake (*Ophedrys vernalis*), northern scarlet snake (*Cemophora coccinea copei*), corn snake (*Elaphe guttata*), eastern kingsnake (*Lampropeltis g. getula*), eastern tiger salamander (*Ambystoma t. tigrinum*), eastern mud salamander (*Pseudotriton m. montanus*), carpenter frog (*Rana virgatipes*), and southern leopard frog (*Rana sphenoccephala*). However, all of these species are more generally distributed throughout the Coastal Plain of Delaware, Maryland, Virginia and North Carolina.

In contrast, the northern pine snake differs from these other species by its apparent absence from the Coastal Plain of Delaware, Maryland, Virginia, and most of North Carolina (Sweet and Parker 1990; Conant and Collins 1991). Indeed, there is little in the way of historical records and no fossil evidence (Sweet and Parker 1990) to suggest

that they ever inhabited this coastal region encompassing some 600 km north to south, from southern New Jersey (Belleplain State Forest in central Cape May County) to southeastern North Carolina (New Hanover County).

We provide two hypotheses to explain this anomaly. (1) The simplest explanation is that pine snakes never occurred in this region. If this is the case, however, why are there no other reptiles that display a distribution pattern similar to this species? (2) A better explanation may be that they originally inhabited this region, but hundreds of years of extensive agriculture, logging and habitat fragmentation of the original pine forests has resulted in extirpation from most of this area with only relict populations remaining. Conant (1979) points out that the New Jersey pine barrens have served as a general refugium for many species of reptiles and amphibians in that densely populated state. These include many of the reptile and amphibian species listed in the above paragraph that are widely distributed throughout the southeastern Atlantic Coastal Plain. But, Conant referred to two species that do not follow this general pattern,

"the pine barrens treefrog (*Hyla andersoni*) and the northern pine snake (*Pituophis melanoleucus*), exhibit broad gaps, but the pattern indicates that their distributions formerly were widespread through the southern Coastal Plain. The sandy soils and pine forests of the more southern parts of the Coastal Plain offer habitats that are similar in many respects to those of the Pine Barrens even though they differ in numerous components."

As we have noted above, Conant (1979) indicates that one of these "components" is "...pitch pine ... which is so abundant in the Barrens, is replaced by other pine species farther south." It may be possible that pitch pine was more widespread along the mid-Atlantic region south of the New Jersey pine barrens during the Pleistocene, but retreated northward at the end of the last glaciation. Pitch pine only occurs where the extreme western population of pine snakes exists in North Carolina. Pitch pine is absent on the Coastal Plain of that state (Little and Garrett 1990), where the dominant pines are loblolly (*Pinus taeda*) (Baker and Langdon 1990) and longleaf (*P. palustris*) (Boyer 1990). Neither of these two pine species occur in New Jersey. However, short-leaf pine (*P. echinata*) (Lawson 1990) and Virginia pine co-occur in both North Carolina and New Jersey where pine snake populations exist.

As noted above, Conant and Collins (1991) among others, indicate that the secretive fossorial habits of this species often result in it being unnoticed by persons familiar with local natural history throughout its range. This is the case even in New Jersey, where many avocational herpetologists have never seen a live pine snake despite many hundreds or thousands of hours afield in a region considered one of this species' population strongholds. Are 2-3 sightings by reliable witnesses and one live specimen too few for a species that may occur in Delaware in very low numbers? Perhaps not, especially considering two other recent significant herpetological discoveries that were made in Delaware during the past two decades. One of these, the barking treefrog (*Hyla gratiosa*), the largest treefrog native to the United States (Caldwell 1982), was only discovered on the Delmarva Peninsula during 1982 in Caroline County, Maryland (Anderson and Dowling 1982). Subsequently, a large breeding colony of this species was

found in Delaware during 1987 in New Castle, County (Arndt and White 1988) and more recently from a small pond in Sussex County (J. White, pers. comm.). In addition, the eastern mud salamander (*Pseudotriton m. montanus*), was only known in Delaware from four historical records, the last of which was from 1956, before it was rediscovered during 1993-94 (Heckscher 1996).

This begs two questions: Have pine snakes persisted on the Delmarva Peninsula in small relict populations? Also, are there undiscovered extant populations of this species in Delaware? Until additional specimens are secured from the areas reported upon above or from other areas within that state, it is impossible to definitively answer these questions. In fact, considering the high rate of forest loss and habitat fragmentation that continues at an alarming pace on the Delmarva Peninsula, the answer to both of these questions may never be known. We suggest, however, that long-term field inventories be conducted in an effort to determine whether one or more populations of this impressive snake are still extant in this region. Such a discovery would fill a major gap in our understanding of the geographic distribution of this fascinating species. It would also automatically elevate the northern pine snake to one of the Delmarva Peninsula's most endangered reptiles.

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Joel W. Snodgrass
Editor

Publication Note

Several changes have been made with this issue of *The Maryland Naturalist*. We have a new editor, Joel Snodgrass, professor of biology at Towson University. The format has been changed from 8 1/2" x 11" to 6" x 9", and the table of contents has been moved to the cover in place of a photograph or an illustration. The Society wishes to thank Arnold W. Norden and D. Earl Redman for their former service as editors of *The Maryland Naturalist*.



